MicroRadarNet: A New Low-Cost Micro Radar Network for Meteorological Purposes

ABSTRACT SUBMISSION FORM
"Managing water in a changing world" - Torino (Italy), July 27-31, 2009

MICRORADARNET: A NEW LOW-COST MICRO RADAR NETWORK FOR METEOROLOGICAL PURPOSES

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Short Abstract

In this paper, an innovative micro radar network for meteorological purposes has been presented. The key aspects of its radar units are a short range strategy (about thirty kilometers) and the implementation of effective enhancing techniques. High resolution spatial and temporal data is processed on-board in real-time, yielding a synthetic and consistent evaluation of the information coming from the sensors. This strategy implies in turn a sensible reduction of the overall operational costs, including management and maintenance aspects, if compared to the traditional long range C-band approach.

In the framework of the European INTERREG IIIB Alpine Space Programme, the Remote Sensing Group at the Politecnico di Torino has being developing this new network from its early ideation stages in 2004. The initial design scenario was specifically tailored to enable along-valley and vertical radar coverage for regions exhibiting a complex orography (e.g. narrow valleys in the Alps). This was achieved by adopting a non-conventional vertical plane sounding approach. To cover a broader range of operational needs, this initial design concept was then extended to include the more traditional horizontal scanning plane as well.

High-performance embedded processing units directly interface with the micro radars, performing in real-time the on-board evaluations on the incoming instrumental data. The overall low power consumption may even allow powering through rechargeable solar cells. Each sensor works as a network node basing on well-assessed 2G cellular radio services. Processed data sets are transmitted to the network servers enabling web-based content fruition.

The result of all the approaches and suggestions above is MicroRadarNet (MRN): a low-cost unmanned X-band micro radar network. MRN is already an operational entity, since a small number

of MRN micro radars have been distributed on the territory. Operational units have been installed on the Politecnico di Torino roof (October 2006), on the roof of the Aosta Valley Civil Protection (March 2007), on an open field in Klagenfurt Airport (September 2007). An ever-growing database of meteorological case studies is being collecting data sets, thus providing a real-data test bench to refine assessment and data enhancements algorithms.

A consistent amount of case studies clearly shows that MicroRadarNet has enough potentialities to provide meteorological information. The proposed strategy, based on a short range sensor network, shall effectively perform high resolution sky soundings while lowering the overall operational costs and integrating with long range C-band radars, thus preventing their shielding and cost shortcomings which typically occur on orographically complex areas.

PREFERRED SECTION: **IWS4**

Type of presentation preferred: **Oral**